WindScanner - Research Infrastructure Center for Wind Energy and Turbulence Research

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WindScanner.eu

on ESFRI Roadmap RI 2010

The RI Center for Wind Energy and Turbulence Research

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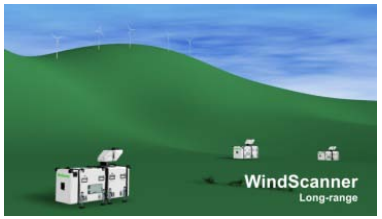


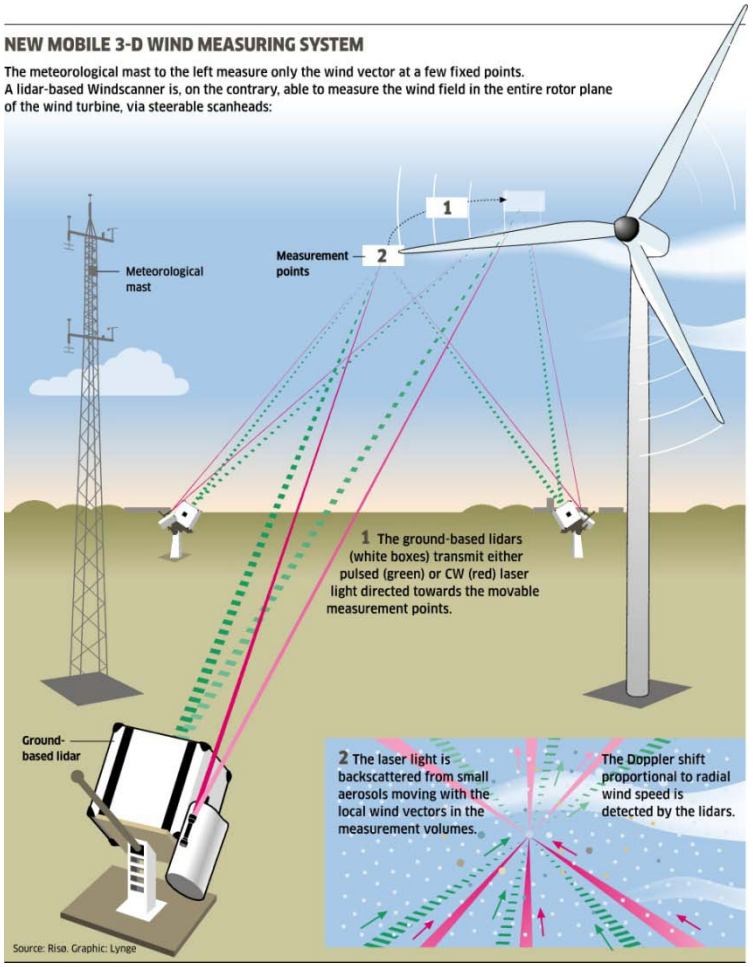
WindScanner.eu

The WindScanner facility" is

-a unique new and distributed infrastructure for research in the large-volume wind fields engulfing today's and tomorrows huge on- and offshore wind turbines.

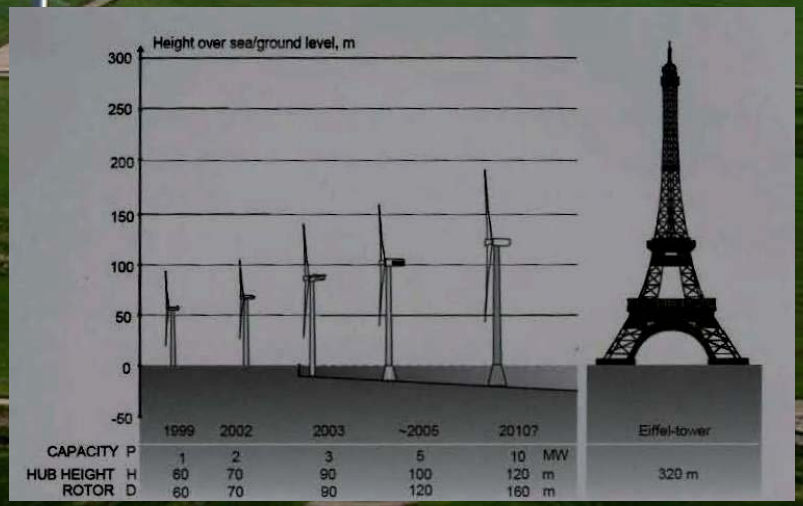
- a "wind tunnel without walls" for renewable energy research spurred from recent advances within mobile laser Doppler wind measurement techniques

- 3-dimensional scanning with wind lidars to determine the instantaneous flow and turbulence fields

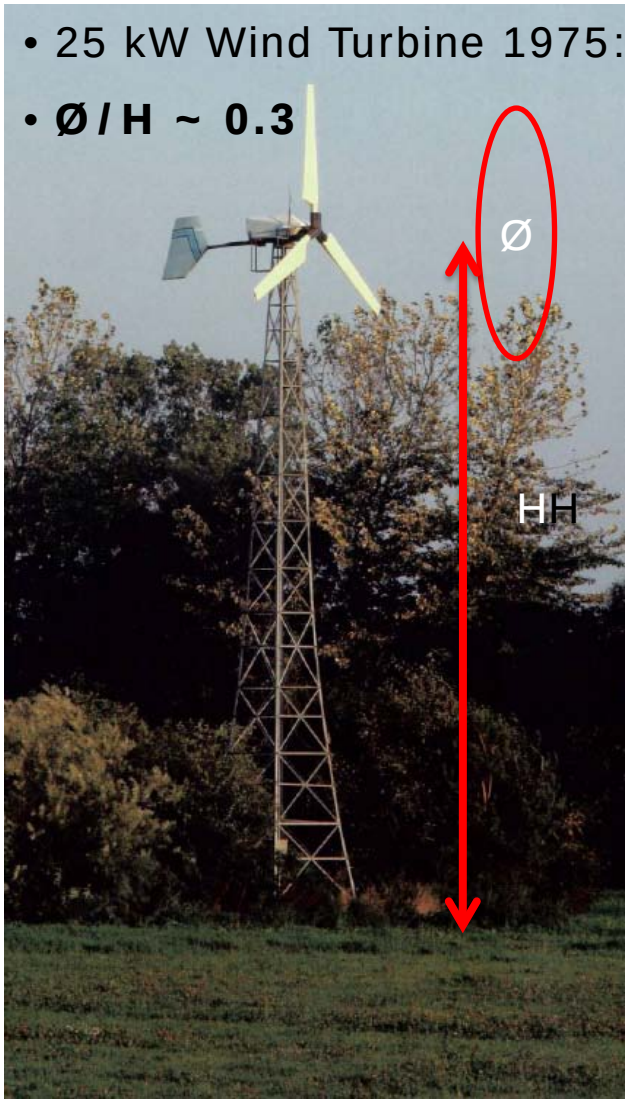


to be implemented by the EERA joint program on wind energy
by the EERA participants: Risø DTU, CENER, ECN, CRES, Fraunhofer IWES, SINTEF & LNEG, (FORWIND)

Wind Turbines – Large objects in complex flow



Høvsøre DK 2007


• 25 kW Wind Turbine 1975:
• Ø / H ~ 0.3
Ø
HH

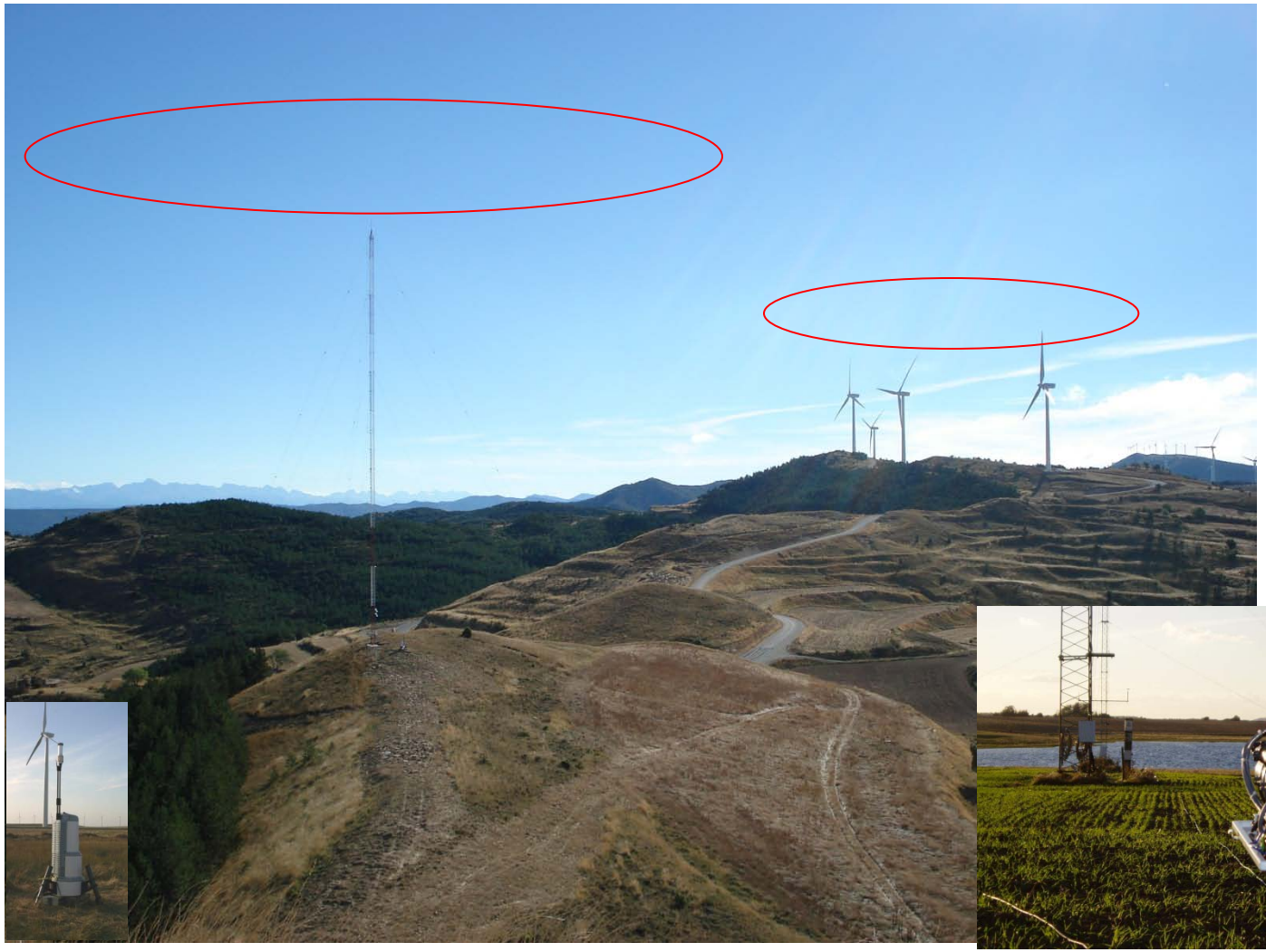

•2.3 MW NM80
• Height 59 m;
• Ø=80H
• Ø / H ~ 1.4

WindScanner VISION I:

Full scale on and offshore measurements on WT arrays & wakes e.g. as here at Horns reef

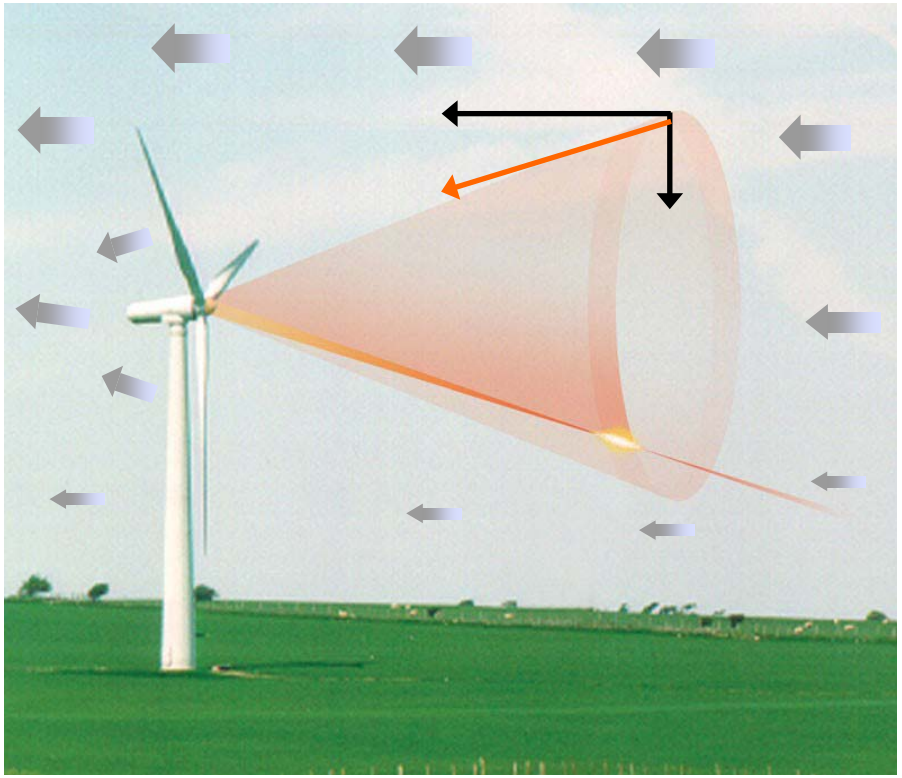
WindScanner Vision II:

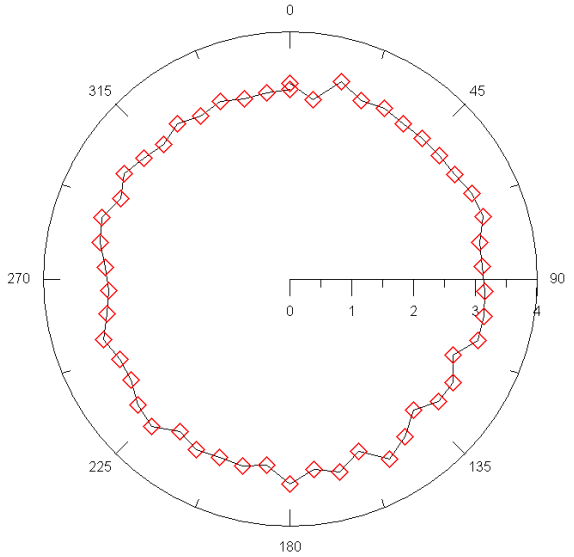
Accurate measurements of wind flow and turbulence, in particular in complex terrain

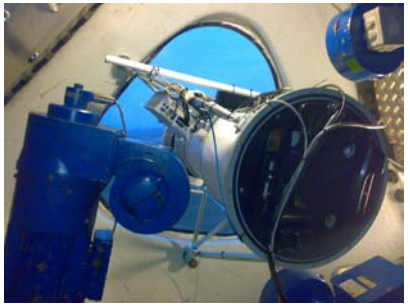


WindScanner Vision III:

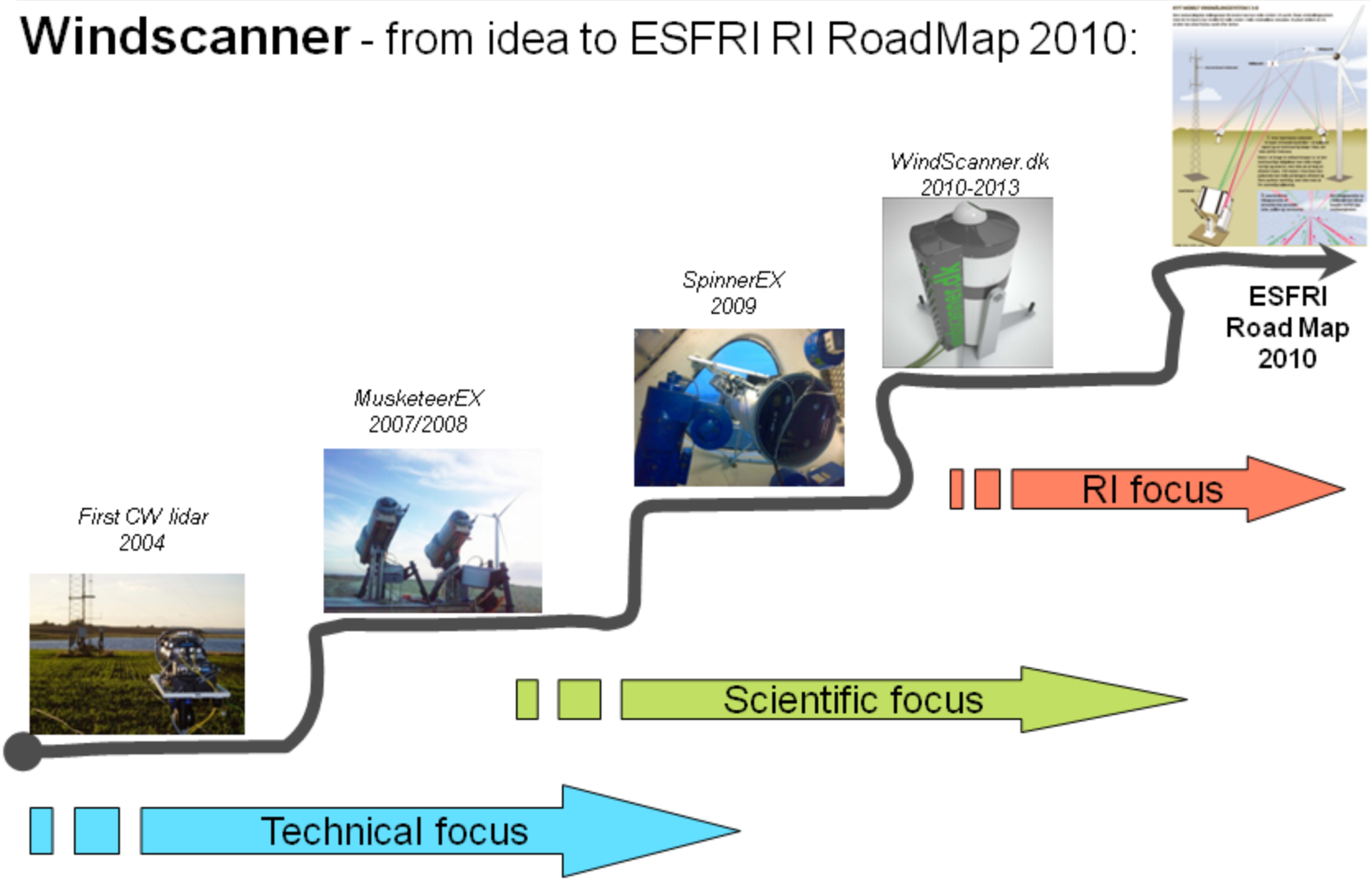
Pro-active control and performance measurements from wind turbine integrated wind lidars





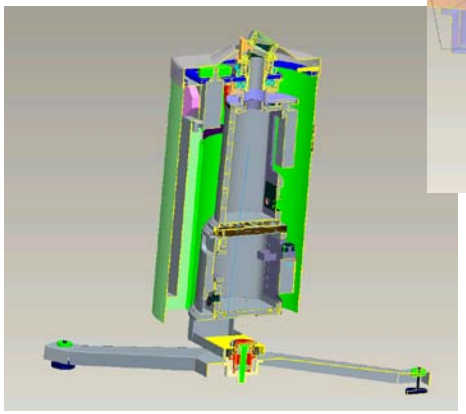


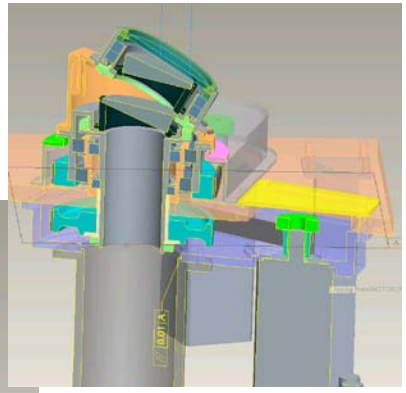
Windscanner - from idea to ESFRI RI RoadMap 2010:



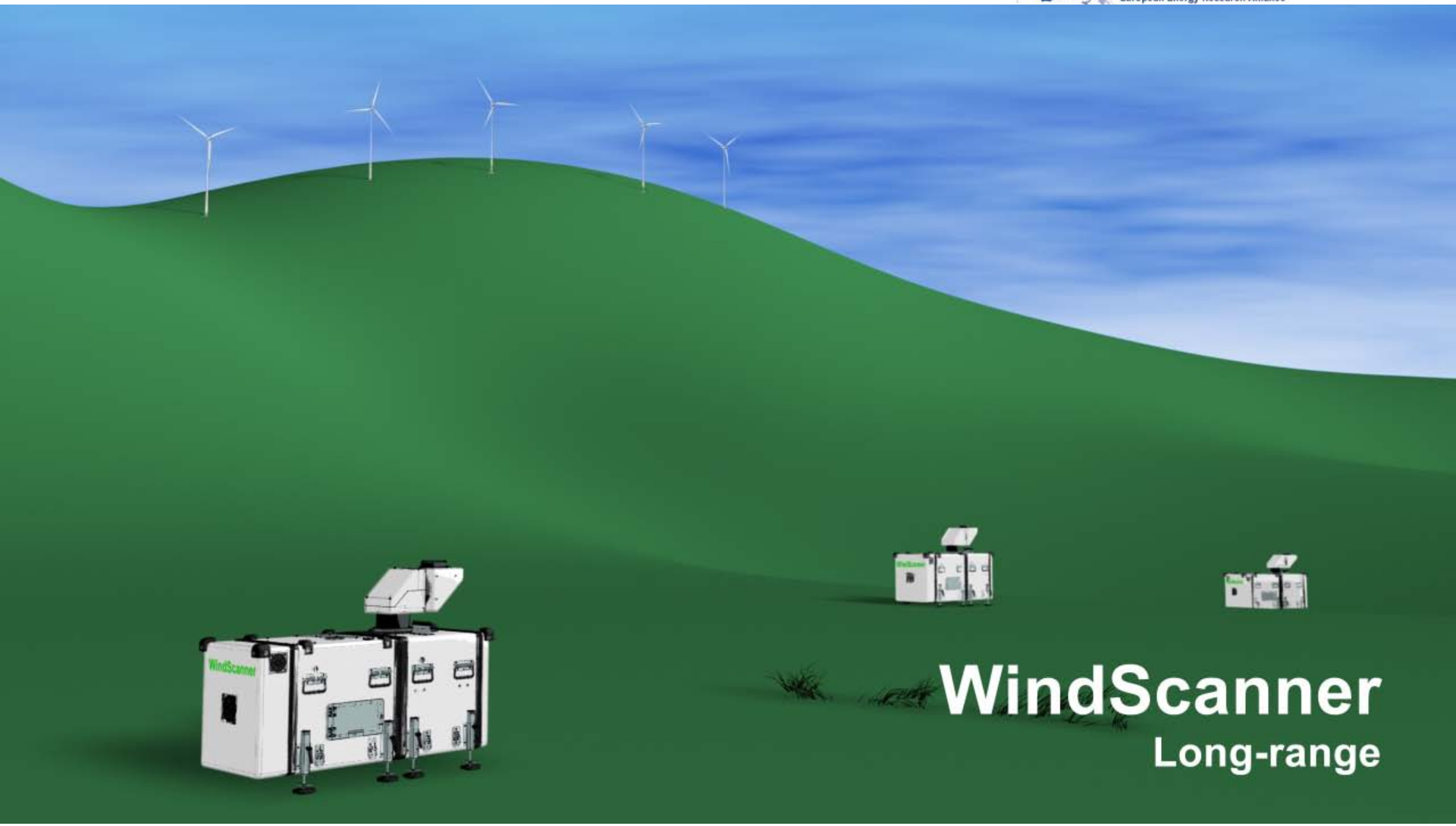
RISØ DTU; CENER; ECN; CRES; Fraunhofer IWES; SINTEF; LNEG/INETI

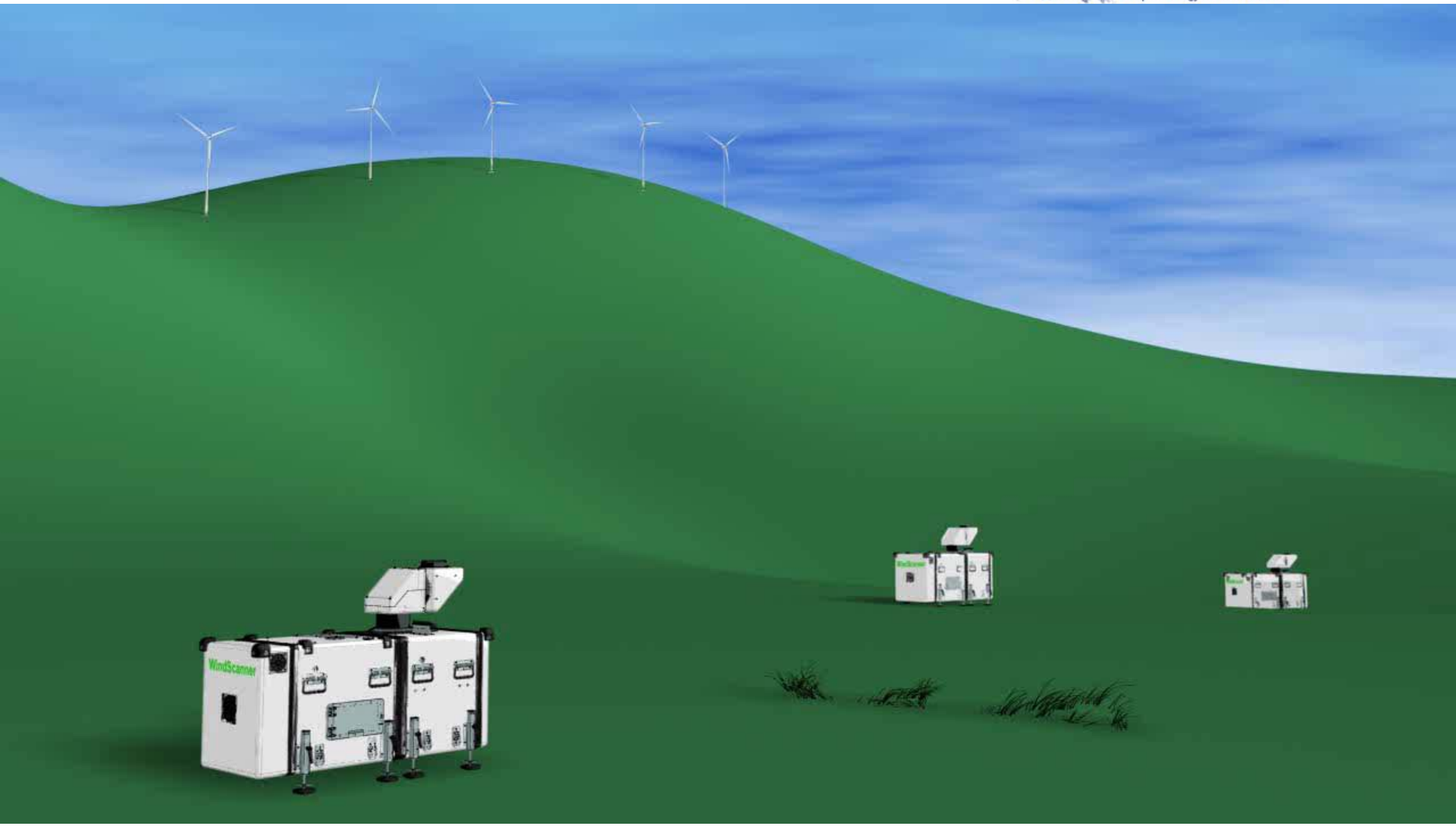
WindScanner hardware






WindScanner
Short-range WindScanner


WindScanner
Long-range


WindScanner


WindScanner
Spinner integrated upwind looking wind lidar


WindScanner
Offshore scanning

We envision -
A new Energy Research Infrastructure

WindScanner.eu - a joint European mobile and distributed experimental RI facility with the aim:

1. to measure the entire 3-D wind and turbulence fields over complex terrain (mountainous, hilly, forest, coastal etc) for optimal wind turbine siting

2. to determine optimal inter-WT spacing and layout for minimizing the effects of wakes

3. to provide real-time upwind wind data for improved and pro-active turbine control during operation at turbulent and problematic (complex terrain) sites - for optimal energy production per unit and per array

4. to establish methodologies for bettering wind turbine's longevity and uptime availability through validation of models and codes for flow and loads

Windscanners

are designed to provide the wind energy society with detailed 3-D wind and turbulence measurements.

Specifically, RI Windscanner.EU will provide the regional **users** of the RI with detailed information on:

1. Secure siting of WT's' and improving the energy efficacy.
2. Wind condition over the entire rotor plane - at all heights.
3. Detailed wind and turbulence data: i) in front, ii) during the passage, and iii) from the wakes behind the wind turbines - on and offshore.
4. Gusts and wind shear at problematic sites in complex terrain

RI Windscanner provide detailed measurements of wind and turbulence in 3-D space and time and at heights up to 200- 300 m aloft and to 5 km in range.

Distributed Wind scanners are envisioned to provide such measurements

On shore	Germany, Denmark, Spain, Holland; Sweden, Finland, …
Off shore	Denmark, Norway, Sweden, Finland, Holland, U.K, …
Complex terrain	Spain, Greece; Norway, Sweden, Portugal, …

WindScanner
ESFRI Roadmap RI 2010:
Centre for Wind Energy and Turbulence Research

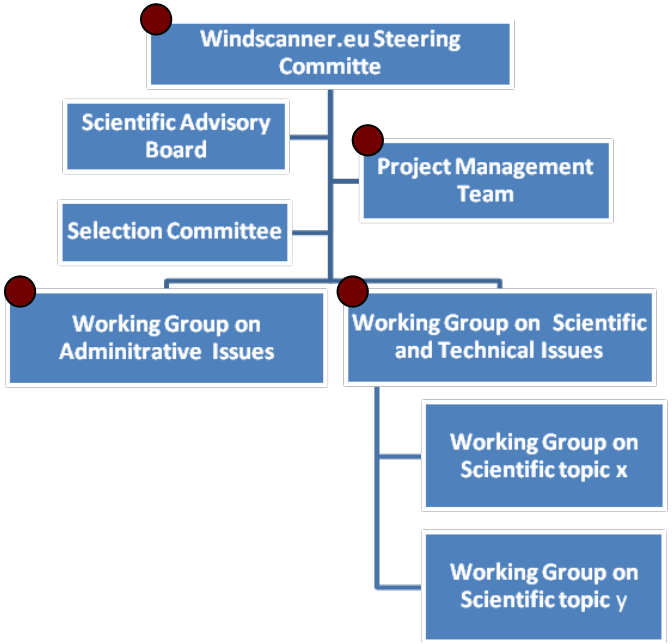
European Dimension: EERA participants and specialities:

- Denmark: Risø DTU (flat terrain wind turbine test station and offshore wind parks, Horns Rev I & II)
- Spain: CENER (inland mountain wind turbine test station, wind tunnels)
- Holland: ECN (research scale wind farm)
- Greece: CRES (coastal complex terrain)
- Germany: Fraunhofer IWES (onshore forested sites, offshore Alpha Ventus, FINO 1-3, Kriegers Flak)
- Norway: SINTEF (offshore technology, floating wind turbines)
- Portugal: LNEG/INETI (complex terrain, offshore)

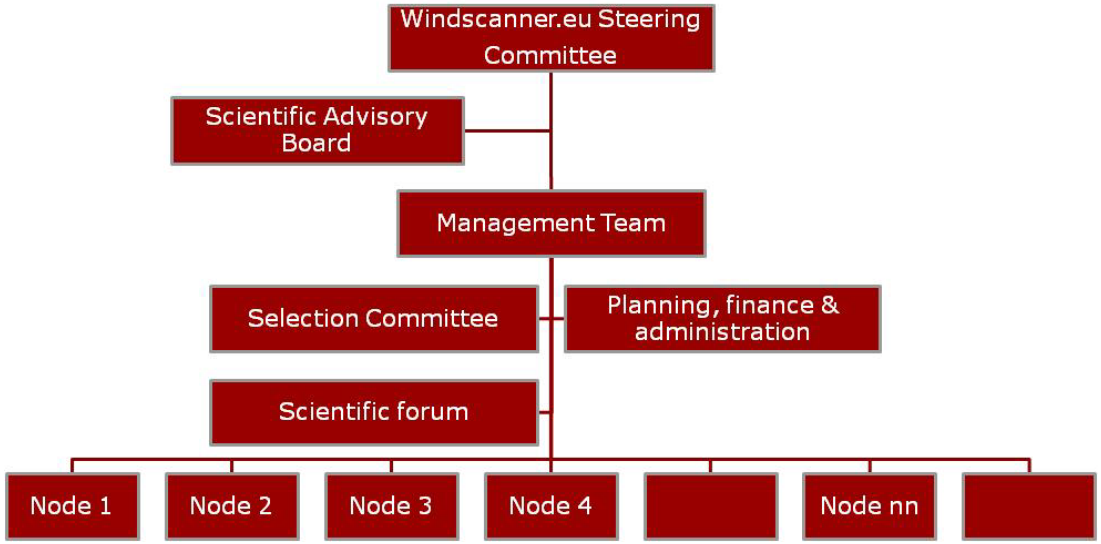
WindScanner will become “public accessible” Worldwide to scientists and to wind energy industry and wind turbine manufactures.

Organizing the WindScanner.eu RI

Preparation phase



Implementation phase



---------- Wind & turbulence ----------
---------- Turbine inflow & wake ----------
---------- Flow in complex terrain ----------
---------- Flow in forests ----------
------ Flow and wakes in offshore wind farms ------
---------- Etc. ----------

WindScanner.eu – Cost estimates

Preparation phase:

WindScanner.dk

- 2007-10 : 2.5 M€
- 2009-13 : 4.5 M€

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(Establish network, policies, procedures, organization, R&D, update design)

- 2011-13 : 5 M€

Implementation phase:

Per node:

- Hardware : 3-5 M€
- Staff : 1 M€/y

(2 scientists, 2 PhDs, 2 techn.)

Total : 50-60 M€

(7 nodes, 3 year period)

Operation : 4 M€

Thank you for your attention

More information:

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WindScanner.eu